5

Deep-sea Fishes of the Bermuda Oceanographic Expeditions. Families Cetomimidae and Rondeletiidae

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(Plate I; Text-figures 1-4)

Contents

Introduction

In connection with the author's systematic and morphological studies on the order Iniomi, Dr. William Beebe and Mr. John Tee-Van kindly made available the strange whale-fishes of the families Cetomimidae and Rondeletiidae obtained by the Bermuda Oceanographic Expeditions of the New York Zoological Society. While this collection comprises only six species and 16 specimens of the family Cetomimidae, it is the largest collection yet studied of one of the rarest families of deep-sea fishes. Apparently only 14 specimens and seven species have previously been recorded in the literature. Of the monotypic family Rondeletiidae, 14 examples have been mentioned in the literature. The Bermuda Expeditions add two more to this number.

The Bermuda material includes all previously known genera of both families and provides the second records and second known specimens of *Cetomimus gillii* Goode & Bean and of *Gyrinomimus simplex* Parr; the third record of *Rondeletia bicolor* Goode & Bean; the fourth record of *Ditropichthys storeri* (Goode & Bean); the fifth record for *Cetostoma regani* Zugmayer; and two new species of the genus *Cetomimus* (*C. craneae and C. teevani*). The most important results of the present investigation are the discovery for the first time of bioluminescent organs in most species of the family Cetomimidae and a unique development of the optic nerve in *Ditropichthys storeri.* In this form the eye is absent and the optic nerve passes to the surface and branches in the region where the eye should be. Also described is a new subgenus, *Psapharocetus,* of the genus *Cetomimus,* for the unique *C. kerdops* Parr. The Bermuda material has been deposited in the fish collection of Stanford University and a series has been retained by the New York Zoological Society.[1]

Practically the entire published work on the families Cetomimidae and Rondeletiidae has been done by three authors. Goode & Bean (1895) discovered both families and described two species of *Cetomimus* and one of *Rondeletia.* The other important reviews of the families are by Parr, in a series of six papers which appeared between 1928 and 1946. His main systematic review (1934) recognized four genera of Cetomimidae, two of which he described as new, and five species, two of which were new. Myers (1946) and Parr (1946b) have an interesting exchange of arguments on the relation-

[1] It is of interest to note that the remaining unworked deep-sea fishes collected by the Bermuda Oceanographic Expeditions have recently been transferred to Stanford University and are now deposited at that institution. The work on this report was done in the Natural History Museum of Stanford University.

ships of the families Cetomimidae, Rondeletiidae and Barbourisiidae. The only osteological studies of the families Cetomimidae and Rondeletiidae are by Parr (1929), describing the osteology of *Cetostoma regani* and *Rondeletia bicolor*. The single other anatomical study is by Brauer (1908) on the histology of the eye of *"Cetomimus gillii"* (identification doubtful). The history of these families can be obtained from Parr's 1928 and 1934 papers.

While considerably more research has been completed on the families Cetomimidae and Rondeletiidae than is included here, it has been deemed advisable to publish at this time only a relatively brief record of the Bermuda material and to save the remainder of the results for a general monographic review to be published in the Carlsberg Foundation reports. Dr. Å. Vedel Tåning of the Carlsberg Foundation has sent me the important world-wide collections made by the "Dana," and Dr. Carl L. Hubbs of the Scripps Institution of Oceanography is lending material obtained in the northeastern Pacific.

For data in regard to nets, localities, depths, etc., concerning the capture of cetomimids and rondeletiids treated in this report, the reader may refer to the articles by Dr. Beebe in *Zoologica* (1931a, 1931b, 1932, 1936). The numbers before the net data are the catalogue numbers of the New York Zoological Society Collection. Part of the cetomimid and rondeletiid material was listed by Beebe (1937).

Acknowledgements

To the New York Zoological Society, Dr. William Beebe and Mr. John Tee-Van, I am much indebted for the opportunity to examine the remarkable Bermuda material and for their enthusiastic cooperation during the preparation of this report. In addition they kindly supplied all field data and illustrations previously prepared. Also I wish particularly to thank Dr. Daniel Merriman and the Bingham Oceanographic Collection for the loan of the types of *Cetomimus kerdops* Parr, *Gyrinomimus myersi* Parr and *G. simplex* Parr; this allowed the study of all known species except *Cetomimus picklei* (Gilchrist) while preparing this report. Dr. Tåning and the Carlsberg Foundation have been most gracious in providing their extensive material of whale-fishes. Dr. George S. Myers aided considerably by intervening on my behalf to borrow the Bingham Oceanographic Collection types and to examine the collections of cetomimids and rondeletiids of the Carlsberg Foundation, and by helping in many other ways. The figures of *Cetomimus teevani* and *C. craneae* were ably prepared by Miss Florence Sprague. The morphological drawings are by the author.

Systematic Position of the Cetomimidae, Barbourisiidae and Rondeletiidae

The family Cetomimidae is a very little known group of deep-sea fishes, members of which have seldom been taken, only a few authors being able to examine specimens. The relationships of the group have been little understood, but it was placed in the order Iniomi by Goode & Bean (1895) and has remained there ever since. Jordan (1923) recognized the Cetomimidae and Rondeletiidae in a distinct suborder (Cetunculi). In general form and a great number of characters the Cetomimidae are most similar to the families Rondeletiidae and Barbourisiidae, and there are many reasons for considering these families to be naturally related. In fact, Myers (1946) goes so far as to place the Barbourisiidae as a subfamily of the Cetomimidae. The situation is paradoxical, however, for the Rondeletiidae are currently placed in the order Berycomorphi and the other two families in the order Iniomi. The rondeletiids used to be recognized as iniomous fishes, but Parr (1929) transferred them to the order Berycomorphi on the basis of osteological characters.

I am not yet prepared to enter wholeheartedly the argument on the systematic position of either the Cetomimidae or the Rondeletiidae, because I have not yet done enough morphological investigation, but perhaps some preliminary comments are in order. Parr's statement (1929, p. 38) that "an examination of *Rondeletia bicolor* Goode and Bean 1895a revealed this species to be a typical representative of the order Xenoberyces introduced by Regan 1911" does not seem justified at this time, nor does his statement "one may . . . also call attention to such a great number of other osteological characters in which *Rondeletia* shows a perfect concordance with the true Berycomorphi . . ." Actually very little has yet been published on the osteology of the group Xenoberyces so that a comparison could apparently be only very limited. Also *Rondeletia* does not seem to show such a perfect agreement with the order Berycomorphi as Parr concludes, for it possesses a great number of structural peculiarities unknown in any other group of fishes. In fact, there is no berycomorph that looks like a rondeletiid, so far as general appearance goes. While Parr may be perfectly right in placing the Rondeletiidae in the group Xenoberyces of the order Berycomorphi, considerably more knowledge is needed of this order before such statements can be fully justified.

One of the questions which comes to mind is that, despite the similarity in general form, and the placing of these families together in pre-

vious classifications, it remains unclear why Parr did not compare the osteology of *Rondeletia* with that of the cetomimid (*Cetostoma regani*) he examined. A possible answer became apparent while examining the cetomimids collected by the Carlsberg Foundation. This material contains some fine large *Cetostoma regani* from many widely separated regions, and it was clearly evident that the osteology of this form is probably the most aberrant in the family, and would be the most difficult from which to trace relationships.

One of the most interesting recent finds of new deep-sea fishes is Parr's (1945) discovery of *Barbourisia rufa,* which he placed in a distinct family of the order Iniomi and compared to the Cetomimidae. Myers (1946) immediately disputed Parr's recognition of the Barbourisiidae and suggested that the genus should be recognized as a subfamily of the Cetomimidae. Parr (1946b) then published a rebuttal to Myers' arguments, and continues to recognize the family Barbourisiidae. Briefly, the main points of their argument are as follows. Parr (1946b, p. 262) separated these two families primarily on the basis of three characters: "*Barbourisia* differs from all cetomimids, 1) by the presence of normal pelvic fins as compared with their complete absence; 2) by a densely spinulose skin as compared with a completely smooth and scaleless skin; 3) by a red color in life and complete absence of melanic elements in the color of the skin, as compared with a melanic pigmentation." Myers (1946) minimizes the importance of these differences, particularly in regard to separating families by the presence or absence of pelvic fins.

What is more revealing is to compare the Barbourisiidae to the Rondeletiidae, which neither Parr nor Myers did. Both groups have almost exactly the same general appearance except that the eye is larger in the latter; the pelvic fins are present in the same position in both groups, but are absent in the Cetomimidae. The distribution and formation of the head pores are the same, differing quite strikingly from the type of pore structure of the cetomimids. There are four gills and a moderate slit behind the fourth in both. The gillrakers are long and slender in both, while they are club-shaped tubercles or flat granular plates in the cetomimids. There are no teeth on the palatines in both, while teeth are always present on the palate in the Cetomimidae. *Barbourisia* differs from both the Cetomimidae and the Rondeletiidae, taken together, in only one significant character: the densely spinulose skin. In regard to Parr's character concerning the red color in life, it is now clear that all three families are red in life. Also, a species of *Gyrinomimus* from the Indo-Pacific lacks most of the melanic pigmentation normally characteristic of the Cetomimidae and is probably quite similar to *Barbourisia* in this respect.

The significance of this comparison between the Rondeletiidae and Barbourisiidae is that, on the basis of Parr's figure and description of *Barbourisia,* the two groups are closely related and separated by relatively few characters. Thus it now appears to be a question of whether this genus warrants separation from the Rondeletiidae, and *not* from the Cetomimidae. Carrying this idea farther—because *Barbourisia* shows several revealing intermediate characters in regard to lateral-line, size of eye, and palate dentition—future investigation might show that all three families should be considered as one. Such a possibility also points out the doubtful propriety of placing these families in separate orders. This is further complicated by the fact that neither family closely resembles any other members of either of the two orders (Iniomi, and Berycomorphi) in which they have been placed.

There is some reason to suspect relationships to the order Lyomeri. It is of significance that the type of luminous tissue found in the Cetomimidae is apparently similar to that found in only one other family of fishes—the Saccopharyngidae of the order Lyomeri. *Saccopharynx harrisoni* Beebe (1932b, p. 64) possesses a unique luminous caudal organ that appears from the illustration to be structurally similar to the cavernous luminous tissue around the dorsal and anal fin of the Cetomimidae. There are other superficial similarities, too. The size of the gape is approximately the same in the whale-fishes and this genus. The texture and structure of the skin seems to be the same. The granular dentition is the same in both groups. These families should be compared further.

Despite a lack of knowledge of their systematic position, the Cetomimidae, Barbourisiidae and Rondeletiidae are so similar as to suggest that they form a natural group widely distinct from all other families of fishes, and deserve at least subordinal designation, no matter where placed in the classification of fishes. Jordan (1923, p. 156) recognized them in the suborder Cetunculi of the Iniomi, and the name would be Cetomimina, using the subordinal terminology of Stenzel (1950, p. 94) that was sanctioned by the Committee on Fish Classification of the American Society of Ichthyologists and Herpetologists (see Committee on Fish Classification, 1950, and Schultz, 1951).

Family Cetomimidae

The Cetomimidae comprise at the present time four genera and nine species from the Atlantic and Indian Oceans. The Indian material is inadequately known from collections of the Deutschen Tiefsee-Expedition of the "Valdivia," reported by Brauer (1906), and of the John Murray Expedition. Following is the classification of the family as presently understood.

Subfamily Ditropichthyinae Parr (1934)
- Genus *Ditropichthys* Parr (1934)
  - *Ditropichthys storeri* (Goode & Bean, 1895)

Subfamily Cetomiminae Goode & Bean (1895)
- Genus *Cetomimus* Goode & Bean (1895)
  - *Cetomimus gillii* Goode & Bean (1895)
  - ***Cetomimus teevani,*** new species
  - ***Cetomimus craneae,*** new species
  - *Cetomimus picklei* (Gilchrist, 1922)
  - *Cetomimus kerdops* Parr (1934)
- Genus *Cetostoma* Zugmayer (1914)
  - *Cetostoma regani* Zugmayer (1914)
- Genus *Gyrinomimus* Parr (1934)
  - *Gyrinomimus myersi* Parr (1934)
  - *Gyrinomimus simplex* Parr (1946)

Dr. Carl L. Hubbs has obtained large examples of the genera *Cetomimus* and *Gyrinomimus* from the Pacific, but no specific determinations have yet been made. Most of the Carlsberg Foundation's material is from the Indo-Pacific and the group is now known to be circumtropical in distribution at great depths.

Diagnosis.—Body moderately short, somewhat compressed, scaleless. Head large, also scaleless. Mouth enormous, generally extending to or moderately behind a vertical from posterior end of cranium. Eyes very small, rudimentary or absent, situated distinctly nearer to upper jaw than to profile of top of head, in middle third of the distance between tip of snout and posterior tip of upper jaw. Teeth granular or cardiform; present on jaws, vomer and palatines; teeth in numerous rows on both jaws. Similar teeth on fused copula and upper pharyngeals. Gillrakers club-shaped or reduced to flat bony plates covered with granular teeth. Gill openings large. Gill membrane free from isthmus. Gills three or four. Dorsal and anal fins far back on body, opposite each other, with a similar number of rays. Adipose and pelvic fins absent. Pectoral fins short, placed rather low. Caudal fin short, moderately forked, truncate, or gently rounded. Lateral-line and lateral-line openings on head and body usually very large. Lateral-line on body a broad hollow tube pierced by large pores. Cavernous, intricately ridged, luminous organs often present around the anus and dorsal and anal fin bases. Luminosity presumed to be red. No photophores present. Body and head covered by a smooth, loose, dark skin. General color when alive brown or orange with brilliant orange or red jaws and fins.

Genus Ditropichthys Parr

The genus *Ditropichthys* is superficially characterized by (1) the posterior tips of the lower jaw situated approximately midway between tip of snout and opercular margin, (2) eyes absent, optic nerve extending out to opaque cornea, (3) granular teeth on the jaws and gillrakers, (4) copula (lingual bone) small, short, the sides parallel and the ends rounded, (5) the presence of spinous, club-shaped gillrakers, (6) four gills, (7) the presence of cavernous luminous tissue only in a small area at the anterior margin of the anus, (8) less than 20 rays in either the dorsal or anal fin, (9) a pair of thin dermal ridges along the ventral edge of the abdomen and a scalloped fold on each side of the anal fin base. The genus *Ditropichthys* presently includes only one species, *D. storeri* (Goode & Bean).

Ditropichthys storeri (Goode & Bean)

Specimens taken by the Bermuda Oceanographic Expeditions.—Two specimens 45.7 and 94.0 mm. in standard length; original standard lengths taken in the field before shrinkage 50 and 103 mm. respectively; from a cylinder of water eight miles in diameter (five to thirteen miles south of Nonsuch Island, Bermuda), the center of which is at 32° 12′ N. Lat., 64° 36′ W. Long.

No. 18,531; net 882; 700 F.; Sept. 13, 1930; 45.7 mm.

No. 22,030; net 1148; 700 F.; Aug. 7, 1931; 94 mm.

Specimens previously recorded.—Three specimens from the Atlantic and Indian Oceans. For synonymy and discussion see Parr (1928, p. 177; 1934, p. 22) and Norman (1939, p. 32). The specimens Parr and Murray & Hjort (1912, pp. 613, 681, fig. 497) record and figure do not appear to be this species.

Description of Bermuda material. — These specimens agree well with the original description, but the smaller example is dried out. Of particular interest is the discovery that there is no eye in this form. Instead, the optic nerve appears to extend out to the opaque cornea and branch in the region where the eye should be. The implication is that the optic nerve is light sensitive. I know of no similar condition in vertebrates and plan to investigate in greater

detail. The cavernous luminous tissue is little developed, and is confined to a small half-moon shaped area bordering the anterior margin of the anus.

Field color notes prepared by Beebe.—No. 18,531, *net* 882, 45.7 *mm. in standard length.* The entire fish is a solid rich dark sepia brown.

No. 22,030, *net* 1148, 94.0 *mm. in standard length.* Interior of mouth and gills Carnelian Red[2]. Skin blackish brown. The dorsal and anal bases, and the mid-dorsal line from behind the fin almost to the caudal fin base pigmented with the same shade of red as the mouth. The bases of the caudal and pectoral fins are faintly tinged with a somewhat lighter shade of red. Finrays Raw Umber.

Genus Cetomimus Goode & Bean

The genus *Cetomimus* is superficially characterized by (1) the posterior tips of the lower jaw reaching or almost reaching the opercular opening, (2) the presence of relatively well developed eyes, (3) granular teeth on the jaws and gillrakers, (4) copula (lingual bone) fairly broad, slightly indented laterally or dumb-bell shaped, (5) the reduction of the gillrakers to flat bony plates, (6) three gills, (7) usually the presence of cavernous luminous tissue around the anus, along each side of the first anal fin rays and often around the dorsal fin origin, (8) less than 20 rays in either the dorsal or anal fin, (9) the absence of ridges on the belly or folds along each side of the anal fin. The genus *Cetomimus* presently includes five species, of which *C. kerdops* Parr and *C. picklei* (Gilchrist) are not included in the Bermuda material. The latter species was not available for study. Since it was discovered to belong in the genus *Cetomimus* subsequent to Parr's review (1934), the original description by Gilchrist (1922) and redescription by Smith (1935) should be consulted. Generic type of *Cetomimus* by subsequent designation *Cetomimus gillii* Goode & Bean.

The five species of *Cetomimus* clearly fall into two subgenera, because *C. kerdops* is so strikingly different from the other species in many characters. In addition the other three species examined, *C. gillii, C. teevani* and *C. craneae,* are closely related to each other, forming a distinct group of their own. It appears from the available descriptions that *C. picklei* belongs with the latter group. Many of the differences of *C. kerdops* from the other species are presented in the relationships of *C. craneae* and *C. teevani,* and in the key to the species of *Cetominus.*

[2] The colors that were identified by comparison to the plates in Ridgway (1912) are capitalized.

Subgenus Cetomimus *Goode & Bean.*—This group contains four species: *C. gillii, C. craneae, C. teevani* and *C. picklei.* Subgeneric type *Cetomimus gillii* Good & Bean. Diagnosis: Head moderately compressed or depressed, considerably wider than body. Posterior tips of lower jaw well separated, not extending posterior to opercular border. Eyes very small, but fully formed. Outline of upper jaw straight, slightly convex or slightly concave. Lateral-line pores 23 or less. Each jaw with five or more longitudinal rows of teeth.

Subgenus Psapharocetus, *new.*—This group contains only one species, and therefore the subgeneric type is *Cetomimus kerdops* Parr. Diagnosis: Head strongly compressed, as wide as body. Posterior tips of lower jaw touching, extending posterior to opercular border. Eye comparatively the largest in the family except for the genus *Cetostoma;* eye fully formed. Outline of upper jaw sigmoid. Lateral-line pores on body 25. Each jaw with three irregular longitudinal rows of teeth. *Psapharo* (delicate); *cetus* (whale).

Key to the Species of the Genus *Cetomimus*

1a. Posterior tips of lower jaw widely separated; head rounded when viewed dorsally; head distinctly broader than body. (Subgenus *Cetomimus* Goode & Bean).

2a. Approximately 10 large pores in the lateral-line between gill opening and caudal fin base. . . *Cetomimus picklei* (Gilchrist)

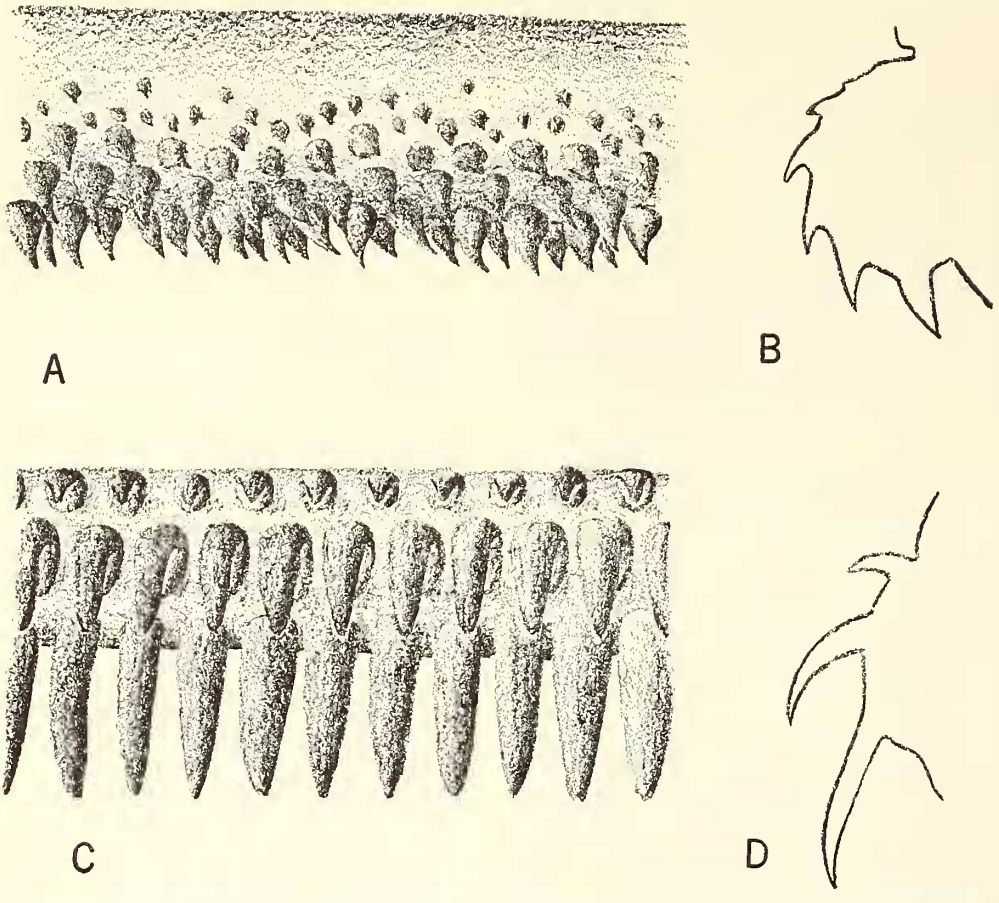
2b. Seventeen or more large pores in lateral-line between gill opening and caudal fin base.

3a. Posterior lateral-line pores without distinct lappets; pectoral fin rays approximately 16; no cavernous luminous tissue around dorsal fin origin. . . . . *Cetomimus gillii* Goode & Bean

3b. Posterior lateral-line pores with large lappets; pectoral fin rays 20-23; cavernous luminous tissue present around dorsal fin origin.

4a. Outline of upper jaw straight posteriorly, slightly convex anteriorly; cavernous dorsal luminous tissue confined to a tiny circular patch around the base of the first dorsal ray; posterior lateral-line pores small, less than half the width of the lateral-line tube, their lappets twice the diameter of the pores. . . . . *Cetomimus teevani,* new species

4b. Outline of upper jaw distinctly curved (concave); dorsal luminous



TEXT-FIG. 1. Main types of premaxillary dentition of whale-fishes. A, side view, and B, cross section, of premaxillary of *Cetomimus gillii* Goode & Bean, NYZS no. 22,677, illustrating the granular dentition characteristic of *Rondeletia*, of all known cetomimids except the genus *Gyrinomimus*, and presumably of *Bourbourisia*. C, side view, and D, cross section, of premaxillary of *Gyrinomimus simplex* Parr, NYZS no. 17,198, illustrating the unique dentition among whale-fishes of the genus *Gyrinomimus*. Since the more primitive cetomimids have the granular teeth, it is likely that the dentition of *Gyrinomimus* is a specialization from an original granular condition.

tissue extensively developed on each side along the base of the first four dorsal rays; posterior lateral-line pores large, equal to the width of the lateral-line tube, their lappets less than the diameter of the pores. . . . . *Cetomimus craneae*, new species

1b. Posterior tips of lower jaw meeting posteriorly; head sharply pointed when viewed dorsally; head as broad as body. (Subgenus *Psapharocetus*, new) . . . . . *Cetomimus kerdops* Parr

CETOMIMUS GILLII Goode & Bean

Text-figs. 1 & 2

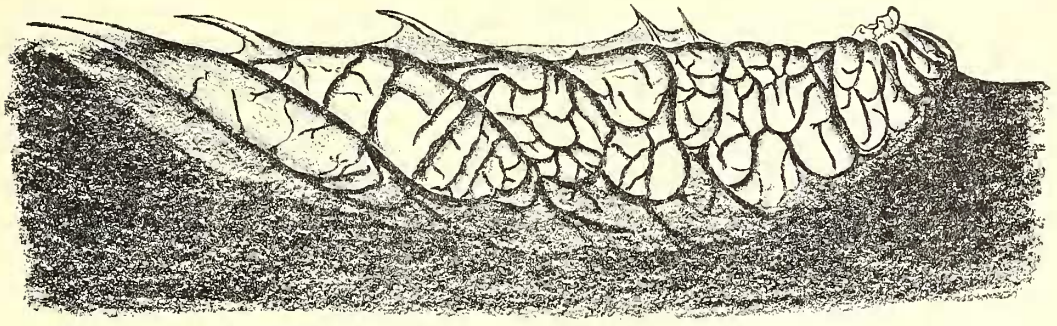
Specimens taken by the Bermuda Oceanographic Expeditions.—Eight specimens 34.8 to 59.8 mm. in standard length; August 9, 1929, to August 21, 1931, at 700 to 1,000 fathoms; from a cylinder of water eight miles in diameter (five to thirteen miles south of Nonsuch Island, Bermuda), the center of which is at 32° 12′ N. Lat., 64° 36′ W. Long.

No. 12,138; net 359; 1,000 F.; Aug. 9, 1929; 37.4 mm.

No. 13,136; net 428; 1,000 F.; Sept. 5, 1929; 38.2 mm.

No. 13,473; net 467; 900 F.; Sept. 12, 1929; 47.7 mm.

No. 17,197; net 780; 900 F.; July 5, 1930; 45.4 mm.



TEXT-FIG. 2. Spongy cavernous luminous tissue around the anus and anterior rays of the anal fin of *Cetomimus gillii* Goode & Bean. Side view facing left of NYZS no. 22,677. This figure is typical of the kind of luminous tissue found around the dorsal and anal fin origins of most cetomimids, although it is often not so well developed. It is believed that luminosity is accomplished by the exudation of a red substance, forming a luminous mucus layer over large portions of the head and body. The luminous tissue is most persistently developed around the anus and first anal fin rays, since it is seldom absent from this region.

No. 18,105; net 862; 800 F.; Sept. 8, 1930; 42.8 mm.

No. 18,628; net 892; 800 F.; Sept. 15, 1930; 59.8 mm.

No. 22,677; net 1203; 900 F.; Aug. 19, 1931; 51.6 mm.

No. 22,778; net 1216; 1,000 F.; Aug. 21, 1931; 34.8 mm.

Specimens previously recorded. — Definitely one specimen from the Atlantic and doubtfully a second from the Indian Ocean. For synonymy and discussion see Parr (1928, p. 176; 1934, p. 24).

Description of Bermuda material. — These specimens agree well with the original description, but as few essential characters were considered in that account, little is actually known of this species. The fact that the present material has approximately 16 pectoral rays, significantly agreeing with the original description in this respect, leads me to believe that this determination is correct. Cavernous luminous tissue is extensively developed around the anus and on each side of the bases of the first five anal rays; completely absent dorsally. Standard lengths were taken by Beebe in the field on two specimens. No. 18,628 was 65 mm. and no. 22,677 was 52 mm.

Field color notes by Beebe.—No. 22,677, *net* 1203, 52 *mm. in standard length.* General color blackish brown with a delicate outer membranous skin of bright Orange Chrome. The orange is especially evident on the ventral region. Inside of mouth Violet-Gray. Buccal valves bright Orange Chrome.

CETOMIMUS TEEVANI, new species

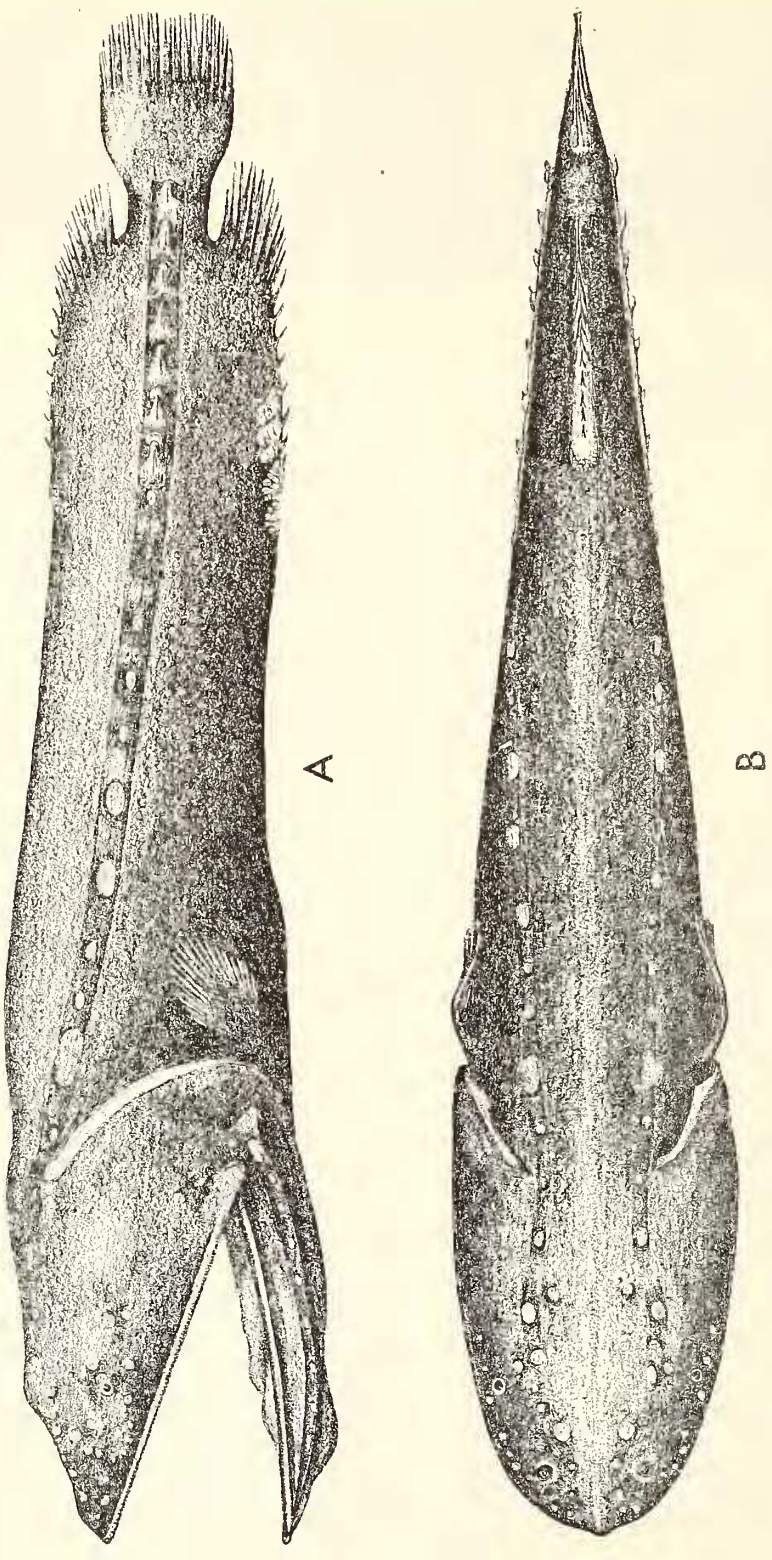
Text-fig. 3

Specimens taken by the Bermuda Oceanographic Expeditions.—Holotype 98.5 mm. in standard length; original standard length taken in field before shrinkage 105 mm.; original number 19,519; Stanford University number 17101; net 961; 700 fathoms; September 29, 1930; from a cylinder of water eight miles in diameter (five to thirteen miles south of Nonsuch Island, Bermuda), the center of which is at 32° 12′ N. Lat., 64° 36′ W. Long.

Description of Bermuda material.—The only known specimen of this species is in excellent condition and well preserved. Even most of the fin rays are still complete.

Body oval in cross section immediately behind head. Greatest depth in region of pectoral fins. Caudal peduncle as long as deep. Anus immediately before anal fin; anus surrounded by extensive cavernous luminous tissue.

Head large, slightly compressed; head width slightly less than greatest head depth. Profile of snout interrupted by moderate bony projections before and above eye. Nostrils not easily distinguished, appearing exactly the same as large head pores. Nostrils without raised rims, close to upper jaw, nearer to tip of snout than to eye. Anterior nostril round, its diameter slightly less than that of the eye. Posterior nostril crescent shaped, twice as large as other nostril, close to but obliquely superior to anterior nostril. Nasal organ oblong, situated in center of anterior nostril, slightly ridged, without development of olfactory laminae. Internasal area equal to di-



TEXT-FIG. 3. A, Side view of holotype of *Cetominus teevani*, new species. B, Top view of holotype of *Cetominus teevani*, new species.

ameter of anterior nostril. A line between eye and tip of snout touches lower border of anterior nostril. Eye very small, slightly nearer upper jaw than profile of head. Interorbital very broad, strongly convex, with a lateral and a median projection. Central part of occiput moderately rounded. Mouth enormous, moderately oblique. Dentigerous margin of upper jaw straight posteriorly, slightly convex anteriorly; that of lower jaw slightly concave. Rictus approximately 3.5 eye diameters before posterior tip of premaxillary. Jaws extend posteriorly almost to opercular margin. Mandible with a short lateral process behind tip of upper jaw and the tip of the angular produced into a short blunt spine. Distance between ricti about 2.2 into upper jaw length. Teeth on jaws granular, in many series on both jaws. The individual teeth are tiny, always pointed, and either conical or incisiform. Dentigerous edge of jaws rounded in cross section and teeth extending from outer to inner face of both jaws. Teeth in upper jaw in five (rarely six) irregular series along entire length of premaxillary. Teeth in lower jaw similar to those in upper, with approximately 120 teeth in the middle series along the mandible, extending posteriorly well beyond angle of gape. Teeth on vomer and palatines similar to those on jaws. Teeth on vomer incisiform, arranged in a circular dome-shaped patch; posteriorly they are in concentric rings; approximately 10 teeth in width and 11 teeth in length across center. Palatine series divided into two patches on each side. The teeth in the anterior section are arranged in about five concentric series; there are about 40 teeth in the longest row. The posterior tip of the anterior patch is slightly over two eye diameters before a vertical from eye. Posterior palatine dentition in a long narrow patch, extending far posterior to rictus; approximately 95 teeth in a median longitudinal series; generally five (sometimes six) series of teeth in width. Teeth on copula in a dumb-bell shaped patch with moderately pointed ends. Length of copular patch about 1.8 in snout length; with 34 rows of irregular teeth along its length; at widest point 14 series of teeth; width of copula one sixth its length. Anteriorly and posteriorly the teeth are formed in distinct wedge-shaped rows somewhat separated from the other copular teeth. The individual teeth on the copula are similar to those on the jaws. Three gill arches present, no slit behind the last. Holobranchs well developed, their length approximately twice the width of the bony gill arch. Gill-teeth granular, similar to those on jaws but smaller. Teeth on hypobranchial of first arch in a long club-shaped patch with five series of teeth at greatest width and 35 series of teeth in the central row along its length. Teeth on ceratobranchial of first arch in a single long patch with 95 teeth in a longitudinal row and five (rarely six) across. Teeth above angle on epibranchial of first arch in two patches. Near angle there is a tiny circular patch of 15 teeth; other patch long and thin, with about 40 teeth in a row along length and four teeth in width. Pharyngobranchial teeth in two elongate dome-shaped patches on each side. Individual teeth similar to those on jaws. Posterior pharyngeal patch long; 30 teeth in length, nine teeth in width. Anterior patch 24 teeth in length and 10 teeth in width.

Lateral-line a broad tube, pierced by 19 pores on body from upper edge of gill opening to base of caudal fin, the last seven pores with well developed flaps on their anterior margins; posterior pores small, much narrower than lateral-line tube; posterior flaps as long as or longer than pores. Lateral-line membrane between pores generally has one or two median mucus-tubes anteriorly and two mucus-tubes (one above the other) posteriorly. Longitudinal keel on membranes between pores only slightly developed. There are eight or nine scattered mucus-tubes on the caudal fin behind the last pore. A few scattered mucus-tubes present on back near head. Numerous large pores and a few mucus-tubes scattered over head. No crescent shaped rows of mucus-tubes above eyes. Skin loose and flabby over head and body; skin smooth, completely lacking scales or spicules. Dorsal cavernous luminous tissue confined to a small patch around the base of the first dorsal ray. Anal luminous tissue moderately well developed around anus and on each side of the bases of the first four anal rays. Otherwise no luminous organs noted.

Dorsal and anal fins far back on body. Dorsal fin origin exactly opposite anal fin origin. Dorsal fin with seven short simple rays followed by eight branched rays and one simple ray. Last two rays separate at base and counted individually. End of dorsal base exactly opposite end of anal base, measured from where the last ray contacts the profile of the body. Posterior rays of dorsal and anal fins much longer than anterior rays. Anal fin with seven short simple rays followed by eight divided rays and two simple rays. Last rays separate at base and counted individually. Pectoral fin short, low, directed obliquely upward, outline evenly rounded; pectoral rays 20 on each side, counted by dissecting the base and staining with alizarin red S. Pelvic fins absent. Caudal fin short, truncate; principal caudal rays 7 + 8.

Coloration.—Uniform solid dark brown in

alcohol. Tips of fins light. Interior of mouth lightly pigmented with brown. Buccal valves dark brown. Inside of operculum more lightly pigmented than interior of mouth. (There are no notes on life-colors accompanying this specimen).

Measurements in percent. of standard length.—Body depth measured at a vertical from region of pectoral fins, 21.5. Caudal peduncle length, which is the oblique distance between the end of the anal base and mid-base of caudal fin, 7.81. Least depth of caudal peduncle, 7.81. Head length measured from the anterior tip of the snout (upper jaw) to the most distant point of the opercular margin including membranous flaps, 37.8. Snout length measured from the tip of the snout (upper jaw) to the anterior margin of the fleshy orbit, 14.1. Upper jaw length, which is the distance between the tip of the snout and posteriormost point of the premaxillary, 30.1. Eye diameter, which is the greatest visible distance, without dissection, across the orbit, and corresponding to the diameter of the opaque cornea, 1.32. Interorbital width, which is the least fleshy width, 12.1. Greatest head width measured between the sides of the premaxillaries, 17.9. Distance between tip of snout and visible base without dissection of first dorsal fin ray, 77.6. Dorsal fin base length from origin of luminous tissue to base of last ray, 17.9. Distance between tip of snout and anus, 76.5. Length of anal fin base from anus to base of last ray, 18.0. Distance of dorsal luminous tissue behind a vertical from anus, 1.32. Length of pectoral fin measured from base of longest middle ray (found by dissection) to its tip, 9.55. Length of caudal fin from mid-base (measured from the fold when the fin is flexed from side to side) to a vertical from tip of longest ray, 12.7. Distance between origin of dorsal luminous tissue and mid-base of caudal fin, 26.7.

Relationships.—This new species belongs in the genus *Cetomimus,* agreeing completely with all characters used to distinguish the genus. In general body proportions and many characters it is intermediate between *Cetomimus gillii* and *C. craneae,* but shows only a distant relationship to *C. kerdops.* The comparisons with *C. gillii* in drawing relationships have been taken from the Bermuda specimens of this species.

Cetomimus teevani differs from the other species of the genus in (1) the formation of the dorsal cavernous luminous tissue (absent in *C. gillii,* well developed along the sides of the first dorsal rays in *C. craneae* and *C. kerdops,* confined to a small patch around the first dorsal ray in *C. teevani*); and (2) the size of the lateral-line pores (in the other species the body pores are the width of the lateral-line, in *C. teevani* most of the posterior pores are much smaller than the lateral-line width). This new species differs from *C. kerdops* and *C. gillii* but agrees with *C. craneae* in the possession of well developed lappets on the posterior lateral-line pores.

Cetomimus teevani further differs from *C. gillii* in the following characters: (1) pectoral rays 20 in the former, 16 in the latter; (2) lower jaw outline when viewed from below distinctly pointed versus evenly rounded; (3) pores bordering upper jaw between nostrils and eye distinctly smaller than eye versus considerably larger; (4) teeth in jaws considerably smaller and less distinct in *C. teevani,* about 160 teeth in the middle row of the premaxillary versus approximately 100.

Cetomimus teevani further differs from *C. craneae* in the following characters: (1) pectoral rays 20 versus 23; (2) head compressed versus as broad as deep, head width 17.9% of standard length as compared to 23.8%; (3) most of the lappets of the posterior lateral-line pores much longer than diameter of pores versus always less than diameter of pores; (4) region above tip of snout lacking mucus-tubes versus covered with over 50 tubes; (5) ends of dorsal and anal fin bases exactly opposite versus dorsal ending distinctly before a vertical from end of anal base.

Cetomimus teevani further differs from *C. kerdops* in the following characters: (1) posterior tips of lower jaw over half the snout length apart versus practically meeting in *C. kerdops;* (2) posterior process of lower jaw not reaching opercular border versus extending well beyond; (3) 19 lateral-line pores on body versus 25; (4) lower jaw inferior versus extending slightly before upper jaw; (5) opercular membranes at isthmus join well behind a vertical from eye versus joining below a vertical from eye.

Name.—This species is named in honor of Mr. John Tee-Van in appreciation of his important part in the Bermuda Oceanographic Expeditions.

Cetomimus craneae, new species

Text-fig. 4

Specimens taken by the Bermuda Oceanographic Expeditions.—Holotype 82.4 mm. in standard length; original number 11,370; Stanford University number 17102; net 269; 800 fathoms; July 8, 1929; from a cylinder of water eight miles in diameter (five to thirteen miles

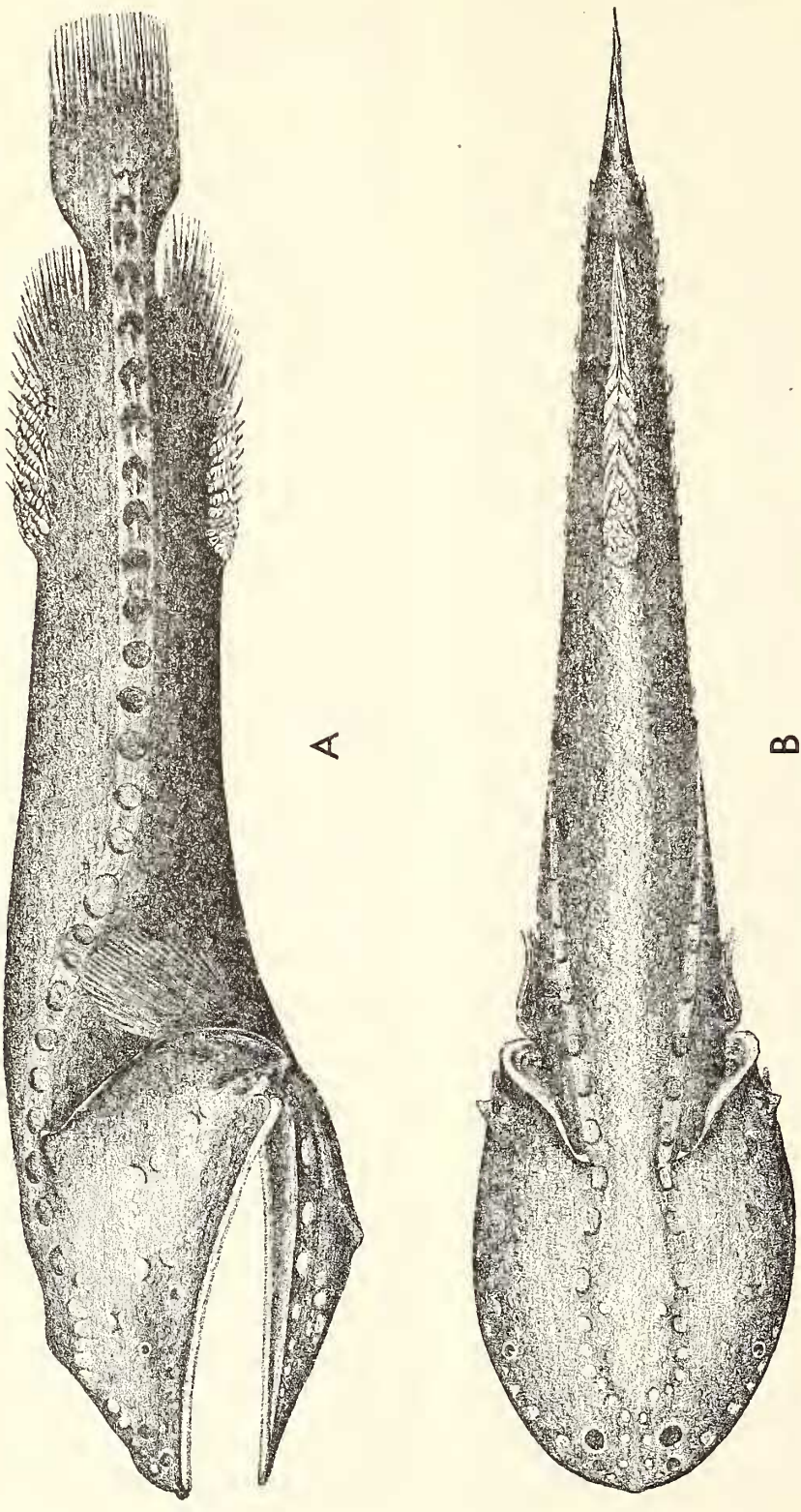
south of Nonsuch Island, Bermuda), the center of which is at 32° 12′ N. Lat., 64° 36′ W. Long.

Description of Bermuda material.—The only known specimen of this species is in exceptionally fine condition and not damaged in any way. Most of the fin rays are still complete.

Body moderately oval in cross section immediately behind head. Greatest depth immediately behind head. Length of caudal peduncle slightly greater than its least depth. Anus immediately before anal fin, surrounded by extensive cavernous luminous tissue.

Head large, its width equal to its depth. Profile of snout evenly rounded onto occiput. Nostrils not easily distinguished, appearing exactly like the head pores. Nostrils round, of equal size, close to premaxillary; both large, without raised rims except that the anterior nostril has a slight swollen lobe at its anterior margin. Nasal organ tear-drop shape, without any trace of distinct olfactory laminae, situated internally between the two nostrils. Internasal membrane same size as diameter of nostrils. A line between eye and tip of snout passes through anterior nostril; posterior nostril above this line. Eye very small, much nearer upper jaw than profile of head. Interorbital very broad, strongly convex, with two median longitudinal humps. Central part of occiput flat. Mouth enormous, moderately oblique. Dentigerous margin of both jaws slightly concave. Rictus approximately four eye diameters before posterior tip of premaxillary. Jaws extend posteriorly to opercular margin. Mandible with a short lateral process behind end of upper jaw and the tip of the angular is produced into a short blunt spine. Distance between ricti about 1.3 into upper jaw length. Teeth on jaws granular, in many series on both jaws. The individual teeth are tiny and either conical with their lengths equal to their basal diameter or else incisiform with a flat outer margin. Edge of jaws rounded in cross section and teeth extending from outer to inner face of both jaws. Teeth in upper jaw in six irregular series along entire length of premaxillary; anteriorly the innermost series is separated from the remaining teeth by a narrow space. There are approximately 140 teeth in the middle row along the premaxillary. Teeth in lower jaw similar to those in upper, with approximately 120 teeth in the middle series along the mandible, extending posteriorly behind angle of gape. Teeth on vomer and palatines similar to those on jaws. Teeth on vomer incisiform, in an oval dome-shaped patch; anteriorly the teeth are in concentric rings. There are approximately 12 teeth across and 14 teeth along the length of the vomer. Palatine series divided into two patches on each side. The teeth in the anterior section are arranged in about twelve concentric series; there are about 40 teeth in longest row. The posterior tip of the anterior patch is an eye diameter anterior to a vertical from the eye. Posterior palatine patch long, fairly broad, extending well posterior to rictus; there are slightly over a hundred teeth in a longitudinal series, 10 series of teeth in width. Teeth on copula in a dumb-bell shaped patch; copula with a moderately pointed anterior end and rounded posterior margin. Length of copular patch about 1.5 in snout length, with 28 rows of irregular teeth along its length; at widest point 17 series of teeth; width of copula one-third its length. Anteriorly the copular teeth are arranged in distinct wedge-shaped rows, posteriorly these merge into a closely packed mass. The individual teeth on the copula are round at the base and incisiform at the tip. Three gill arches present, no slit behind last. Holobranchs well developed, their lengths approximately twice the width of the bony gill arch. Gill-teeth granular, similar to those on jaws but more feebly developed. Teeth on hypobranchial of first arch in a single flat club-shaped patch; six series of teeth at greatest width and 30 teeth in middle row along its length; the individual teeth are in irregular longitudinal series. Teeth on ceratobranchial of first arch in a single long bony patch of irregular outline; the teeth are in irregular patches, some in longitudinal series and others in oblique series; there are approximately 90 teeth in longitudinal series and 10 across the bone. Teeth above the angle on epibranchial of first arch in two patches; near angle there is a small crescent-shaped patch of about 10 teeth in width; other patch long and thin with about 28 teeth along its length and six teeth across its width. Pharyngobranchial teeth developed in two cone-shaped bony patches on each side; individual teeth similar to those on jaws. Posterior pharyngobranchial patch oval, 24 teeth in length, 15 teeth in width. Anterior patch 23 teeth in length and 12 teeth in width.

Lateral-line a broad tube pierced by 22 large pores on body, the last nine pores with well developed flaps on their anterior margins; lateral-line pores same size as tube, their lappets always shorter than diameter of pores. In addition, the last sections have a longitudinal keel on the membranes between the pores. Lateral-line membranes between pores generally have one median mucus-tube anteriorly and two mucus-tubes (one above the other) posteriorly. There are eight mucus tubes in groups of two on the caudal fin behind the last lateral-line pore. Scattered mucus-tubes present along mid-



TEXT-FIG. 4. A, Side view of holotype of *Cetominus craneae*, new species. B, Top view of holotype of *Cetominus craneae*, new species.

line of back. Lateral-line pores continued on head forward onto snout. Numerous large cavernous pores and many mucus-tubes scattered over head. No crescent-shaped rows of mucus-tubes above eyes, but a curved row is present across interorbital on top of head. Skin loose and flabby over head and body, completely lacking scales or spicules. Cavernous luminous tissue well developed around origins of dorsal and anal fins and on each side of the bases of the first four rays of these fins; also extensively formed around anus. Otherwise no luminous organs noted.

Dorsal and anal fins far back on body. Dorsal fin origin slightly anterior to anal fin origin. Dorsal and anal fin with seven short simple rays followed by nine branched and one simple ray. Last two rays separate at base and counted individually. End of dorsal base slightly in advance of anal fin base. Posterior rays of dorsal and anal fins much longer than anterior rays. Pectoral fin short, fairly low, directed obliquely upward, outline evenly rounded. Pectoral rays 23 on each side; counted by dissecting pectoral fin base. Pelvic fins absent. Caudal fin short, slightly emarginate; principal rays 6 + 8.

Coloration.—Uniform solid dark brown in alcohol. Tips of fins light. Roof of mouth lightly pigmented brown; floor of mouth darker. Buccal valves dark brown. Inside of operculum lightly pigmented brown.

Field color notes prepared by Beebe.—The fish at first was a dark brown tinged with Terra Cotta. Before being put in preservative the epidermis became loose. After a night in 3% formalin, the entire epidermis was blown away with a pipette. The fish then became a dark Seal Brown. (It is probable that the "epidermis" referred to was a coating of coagulated mucus, for the fish still possesses its epidermis).

Color notes from field drawings.—Two color illustrations were prepared of the holotype by Helen Tee-Van (B127, no. 284). One of them shows the specimen as being a solid orange over head, body and fins and must have been prepared before preservation. The other illustration is in much greater detail and corresponds to Beebe's notes. The general color is a dark brown. The jaws, fins and pores are tinged with orange, particularly the cavernous luminous tissue and vertical fins.

Measurements in percent. of standard length.—Body depth measured at a vertical from posterior tip of head, 20.9. Caudal peduncle length, which is the oblique distance between the end of the anal fin base and mid-base of caudal fin, 10.6. Least depth of caudal peduncle, 5.70. Head length measured from the anterior tip of the snout (upper jaw) to the most distant point on the opercular margin including membranous flaps, 36.7. Snout length measured from the anterior tip of the snout (upper jaw) to the anterior margin of the fleshy orbit, 12.5. Upper jaw length, which is the distance between the tip of the snout and posteriormost point of the premaxillary, 28.9. Eye diameter, which is the greatest visible distance without dissection across the orbit, .85. Interorbital width, which is the least fleshy width, 14.9. Greatest head width measured between posterior tips of lower jaw while head was freely suspended, 23.8. Distance between tip of snout and visible base without dissection of first dorsal fin ray, 76.7. Dorsal fin base length from origin of luminous tissue to base of last ray, 18.6. Distance between tip of snout and anus, 70.8. Length of anal fin base from anus to base of last ray, 18.4. Distance of dorsal luminous tissue before a vertical from the anus, 2.31. Distance between end of dorsal fin base posteriorly to a vertical from end of anal fin base, .85. Length of pectoral fin measured from base of longest middle ray (found by dissection) to its tip, 8.86. Length of caudal fin from mid-base (measured from the fold when the fin is flexed from side to side) to tip of longest ray, 10.2. Distance between origin of dorsal luminous tissue and mid-base of caudal fin, 29.4.

Relationships.—This new species clearly belongs in the genus *Cetomimus*, agreeing completely with all characters used to distinguish the genus. In general body proportions and many characters this species is most closely related to *C. teevani* and shows the closest relationships to the genus *Gyrinomimus* of any species outside that genus. The head is broad, and the outlines of the jaws distinctly concave as in *Gyrinomimus*. This new species is much more closely related to *C. gillii* than to *C. kerdops*.

Cetomimus craneae differs from the other species of the genus in (1) the more extensive development of the cavernous tissue than any other known species in the family; (2) having the head as broad as deep versus distinctly compressed in the other species of *Cetomimus;* (3) having the highest number of pectoral fin rays in the genus, 23 versus 16-20; (4) the presence of great numbers of mucus-tubes over the head and back which are only sparsely present in the other species; this condition is most closely approached by *C. gillii,* but there are considerably fewer in this form.

Cetomimus craneae further differs from *C. gillii* in the following characters: (1) outline of jaws distinctly concave versus straight in *C.*

gillii; (2) posterior lateral-line pores possessing well developed lappets versus lappets vestigial or absent; (3) dorsal cavernous luminous tissue present versus absent; (4) pores bordering upper jaw between nostrils and eye distinctly smaller than eye versus considerably larger than eye; (5) sides of copular patch strongly indented versus practically straight.

Cetomimus craneae further differs from *C. kerdops* in the following characters: (1) Posterior tips of lower jaw over three-fourths of the snout length apart versus practically meeting in *C. kerdops;* (2) opercular membranes at isthmus join well behind a vertical from eye versus joining below a vertical from eye; (3) posterior lateral-line pores possessing well developed lappets versus lappets absent; (4) sides of copular patch strongly indented versus practically straight; (5) head considerably wider than body versus as wide as body.

Further comparisons to the other species of *Cetomimus* are given in the section on relaships of *C. teevani.*

Name.—This unusual fish is named in honor of Jocelyn Crane in recognition of her work on deep-sea fishes.

Genus Cetostoma Zugmayer

The genus *Cetostoma* is superficially characterized by (1) having the posterior tips of the lower jaw extend well posterior to the opercular opening, (2) the presence of relatively completely developed eyes, (3) having granular teeth on the jaws and gillrakers, (4) having the copula (lingual bone) very narrow, long and slender, somewhat expanded at anterior tip, (5) the reduction of the gillrakers to flat bony plates, (6) having three gills, (7) the presence of a tiny area of modified cavernous luminous tissue on each side of anus, but none elsewhere, (8) having approximately 30 rays in both dorsal and anal fins, and (9) the presence of a low ventral median fold on belly from below pectoral fins to anus, but lack of folds on each side of anal fin. The genus *Cetostoma* includes a single remarkable species, *C. regani* Zugmayer, which shows many unique differences from all other genera. Its closest relationships lie with *Cetomimus kerdops.* It should be noted that this determination of genus and species is made on the basis of Parr's findings, because Zugmayer's original description is useless.

Cetostoma regani Zugmayer

Specimens taken by the Bermuda Oceanographic Expeditions.—Two specimens 41.8 and 43.7 mm. in standard length; original number 17,196; net 778 at 700 fathoms, July 5, 1930; from a cylinder of water eight miles in diameter (five to thirteen miles south of Nonsuch Island, Bermuda), the center of which is at 32° 12′ N. Lat., 64° 36′ W. Long.

Specimens previously recorded.—Three specimens from the Atlantic. See Parr (1934), and Murray & Hjort (1912, pp. 613, 682, fig. 498).

Description of Bermuda material.—Both specimens are in rather poor condition, having partially dried out at one time, but there appears to be no question of their identity. The standard lengths were probably 10-15 mm. longer before preservation. Normal cavernous luminous organs are not present in this form, but there appears to be modified luminous tissue of this basic type in a small narrow ridge on each side of the anus.

Genus Gyrinomimus Parr

The genus *Gyrinomimus* is superficially characterized by (1) the posterior tips of the lower jaw reaching the opercular openings, (2) the presence of relatively well developed eyes, (3) having elongate cardiform teeth on the jaws and granular teeth on the gill arches, (4) having the copula (lingual bone) broad, shield-shaped, moderately pointed anteriorly and expanded laterally posteriorly, (5) the reduction of the gillrakers to flat bony plates, (6) having three gills, (7) the complete absence of cavernous luminous tissue, or if such is present, by having it only faintly formed around base of first dorsal ray and around anus, (8) having less than 20 rays in both the dorsal and anal fins, and (9) the absence of ridges on the belly or folds along each side of the anal fin. The genus *Gyrinomimus* includes two species of which *G. myersi* is not included in the Bermuda material. Generic type by original designation, *Gyrinomimus myersi* Parr. This genus is most closely related to *Cetomimus,* particularly through *C. craneae,* to which it shows the greatest similarities.

Gyrinomimus simplex Parr

Text-fig. 1

Specimens taken by the Bermuda Oceanographic Expeditions.—One specimen 48.3 mm. in standard length; original standard length before shrinkage 54 mm.; original number 17,198, net 732 at 900 fathoms, June 27, 1930; from a cylinder of water eight miles in diameter (five to thirteen miles south of Nonsuch Island, Bermuda), the center of which is at 32° 12′ N. Lat., 64° 36′ W .Long.

Specimens previously recorded.—One specimen from the Atlantic. See Parr (1946).

Description of Bermuda material.—This specimen agrees well with the holotype. The posterior

lateral-line pores are round, completely lacking lappets. No cavernous luminous tissue.

Family Rondeletiidae

The family Rondeletiidae has been reported upon only three times. The original description (later copied by various authors) was made by Goode & Bean (1895) from a single specimen, which was placed in the order Iniomi. Parr (1928) recorded and briefly described 13 specimens, and in 1929 he considered the osteology in considerable detail, placing the family in the group Xenoberyces of the order Berycomorphi. As previously stated, Myers (1946) and Parr (1946b) have interesting arguments about the systematic position of this family. Apparently only two illustrations giving the aspect of the unique species have been prepared. The first figure appeared with the original description by Goode & Bean and has been used by several subsequent authors. The second illustration is a colored plate prepared under the direction of Dr. William Beebe that has appeared in the National Geographic Magazine (Beebe, 1931). Since this latter plate is of considerable importance in establishing the coloration of this group and is more accurate than the original figure, it has been reproduced with this paper.

The Rondeletiidae include only one genus and species, *Rondeletia bicolor* Goode & Bean.

Rondeletia bicolor Goode & Bean

Plate I

Specimens taken by the Bermuda Oceanographic Expeditions.—Two specimens 24.7 and 86.7 mm. in standard length; original standard lengths taken in field before shrinkage 25.7 and 97 mm. respectively; from a cylinder of water eight miles in diameter (five to thirteen miles south of Nonsuch Island, Bermuda), the center of which is at 32° 12′ N. Lat., 64° 36′ W. Long.

No. 13,434; net 463; 1000 F.; Sept. 11, 1929; 86.7 mm.

No. 23,339; net 1291; 600 F.; Sept. 12, 1931; 24.7 mm.

Specimens previously recorded. — Fourteen specimens from the Atlantic. See Parr (1928, p. 179; 1929, p. 39).

Description of Bermuda material.—The two Bermuda examples agree quite closely with the previous descriptions. No luminous structures are found, but it is believed that the orange areas in life are luminous. It is of particular significance that its coloration in life is very similar to that known for most members of the Cetomimidae.

Field color notes by Beebe. — The colored plate of this species has obviously been prepared from no. 13,434, but the original color notes are not available. From the color plate it can be seen that the fish is dark brown with bright reddish-orange jaws, and that the fin bases are also reddish-orange.

No. 23,339, *net* 1291, 24.7 *mm. in standard length.* General color blackish-brown. The pelvic fins are strikingly webbed with scarlet. Remainder of color notes not complete enough to be included.

Summary

The families Cetomimidae and Rondeletiidae are remarkable groups of rare luminous whale-like fishes, about two to six inches long, which have been sporadically collected in the Atlantic and Indian Oceans. The systematic position of these families has aroused some argument, but appears to be in the neighborhood of the orders Iniomi, Berycomorphi, and perhaps the Lyomeri. The families Cetomimidae, Barbourisiidae and Rondeletiidae seem to form a naturally related group with the second named group intermediate in position, but considerably closer to the Rondeletiidae.

Previous specimens of the family Cetomimidae had been placed in four genera and seven species. In the course of the oceanographic work of the Department of Tropical Research of the New York Zoological Society, during nine years' investigation within an eight-mile circle off Bermuda, sixteen cetomimids and two rondeletiids were obtained. This collection, while small in number, has added considerably to our knowledge of these excessively rare fishes. This material again shows the great value of concentrated research to find out just what part of the total bathypelagic fish fauna could be taken in a restricted area. In regard to the Cetomimidae and Rondeletiidae, all known genera were taken and all but three of the previously known species. In addition two new species of the genus *Cetomimus* were collected (*C. craneae, C. teevani*), these being of particular value in tracing the relationships of the genera *Cetomimus* and *Gyrinomimus*. All the Bermuda material was taken between the depths of 700 and 1,000 fathoms.

Dr. Beebe's field notes give the first life color information ever obtained on these strange fishes. These notes reveal the "orange-mouths," or "giant-mouth orange-skins" as Beebe termed them, to be usually of a solid orange or brown in life with bright orange or reddish-orange mouths and fins.

Bioluminescence has not been previously dis-

cussed in the family Cetomimidae, although these fishes are apparently luminous. Most species of this family have peculiar webbed, spongy, cavernous tissue around the anus and the first dorsal and anal fin rays; these tissues appear to represent luminous organs. This type of luminous structure appears to be similar to that found in only one other species of fish, *Saccopharynx harrisoni* Beebe, a gulper eel of the order Lyomeri. Since the cavernous tissue of the cetomimids is red or reddish-orange in life, it is presumed that the luminescence may also be of these colors. The peculiar luminous tissue of *S. harrisoni* glows scarlet, apparently showing a similarity to the cetomimids in this respect.

A remarkable discovery is the complete absence of eyes in the cetomimid, *Ditropichthys storeri*. Instead, the optic nerve extends out to a heavily pigmented area in the opaque cornea and branches near the surface of the skin. The implication is that the optic nerve is light-sensitive but further study is needed before more can be said of this condition, which is unique among vertebrates.

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EXPLANATION OF THE PLATE.

Plate I.

Adults of the rare whale-fish, *Rondeletia bicolor,* feeding on very small crustaceans. The coloration was noted before preservation, establishing that these unusual fishes are red in life to a considerable extent. (From a painting by E. Bostelmann).